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(54) CODER AND DECODER FOR IMAGE SIGNAL

(57)Abstract:

PURPOSE: To realize coding and decoding of an image at a sable speed independently of an upper limit of an input and output speed of a storage device and a transmission line being input and output destination of coded data.

CONSTITUTION: The coder for an image signal having a block part division means 1an orthogonal transformation means 2a quantization means 3 and a variable length coding means is provided with a band split means 4 splitting quantization coefficients into plural subsets being mutually primeplural variable length coding means 5a5b5c applying variable length coding processing to each partial set of the quantization coefficient to obtain code data of each partial set and plural storage or transmission means 6a6b6c storing or sending individually the code data of each subset.

CLAIMS

[Claim(s)]

[Claim 1]A block division means which divides a picture signal into a picture element block which is a rectangular area of a MxN pixel (M and N are positive integers)comprisingCoding equipment of a picture signal provided with an orthogonal transformation means which performs orthogonal transformation to

said picture element blockand calculates a conversion factora quantization means which quantizes said conversion factor in the predetermined quantization characteristicand obtains a quantization coefficientand a variable-length-coding means to carry out variable length coding of said quantization coefficientand to obtain code data.
A zone division means to divide said quantization coefficient into two or more relatively prime subsets.
Two or more variable-length-coding means to carry out variable length coding for every subset of said quantization coefficientand to obtain code data for every subset.
Two or more memory or transmission means which memorize or transmit code data for said every subset individually.

[Claim 2]A block division means which divides a picture signal into a picture element block which is a rectangular area of a MxN pixel (M and N are positive integers)comprisingCoding equipment of a picture signal provided with an orthogonal transformation means which performs orthogonal transformation to said picture element blockand calculates a conversion factora quantization means which quantizes said conversion factor in the predetermined quantization characteristicand obtains a quantization coefficientand a variable-length-coding means to carry out variable length coding of said quantization coefficientand to obtain code data.
A zone division means to divide said conversion factor into two or more relatively prime subsets.
Two or more quantization means which quantize for every subset of said conversion factorand obtain a quantization coefficient for every subset.
Two or more variable-length-coding means to carry out variable length coding of the quantization coefficient for said every subsetand to obtain code data for every subset.
Two or more memory or transmission means which memorize or transmit code data for said every subset individually.

[Claim 3]When dividing said conversion factor or said quantization coefficient into two or more relatively prime subsetssaid conversion factorOr claim 1 setting up a boundary of division by the position of a one-dimensional series acquired by scanning zigzag from low-passapplying inside of a matrix of said quantization coefficient to a high region or coding equipment of the picture signal according to claim 2.
[Claim 4]Memory or a transmission means characterized by comprising the following which memorizes or transmits code dataA variable-length decoding means which carries out variable-length decoding of said code dataand obtains

a quantization coefficientA decoding device of a picture signal provided with an inverse quantization means to carry out inverse quantization of said quantization coefficientand to obtain a conversion factoran inverse-orthogonal-transformation means to carry out inverse orthogonal transformation of said conversion factorand to obtain a decoding picture element blockand a block synthesizing means that compounds said decoding picture element block and generates a decoded image signal.
Memory which memorizes or transmits code data for said every subset individuallyor a transmission means.
Two or more variable-length decoding means which carry out variable-length decoding of the code data for said every subset individuallyand obtain a quantization coefficient for every subset.
A band composition means to compound a quantization coefficient for said every subsetand to obtain a quantization coefficient for 1 block.

[Claim 5]Memory or a transmission means characterized by comprising the following which memorizes or transmits code dataA variable-length decoding means which carries out variable-length decoding of said code dataand obtains a quantization coefficientA decoding device of a picture signal provided with an inverse quantization means to carry out inverse quantization of said quantization coefficientand to obtain a conversion factoran inverse-orthogonal-transformation means to carry out inverse orthogonal transformation of said conversion factorand to obtain a decoding picture element blockand a block synthesizing means that compounds said decoding picture element block and generates a decoded image signal.
Memory or a means of memorizing or transmitting code data for said every subset individually.
Two or more variable-length decoding means which carry out variable-length decoding of the code data for said every subset individuallyand obtain a quantization coefficient for every subset.
Two or more inverse quantization means to carry out inverse quantization of the quantization coefficient for said every subset individuallyand to obtain a conversion factor for every subset.
A band composition means to compound a conversion factor for said every subsetand to obtain a conversion factor for 1 block.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the coding decoding device of a picture signal.
[0002]
[Description of the Prior Art]The technique of coding gradation images and a color picture efficiently is devised variously until now. There are reversible encoding which can reproduce the same image as an original imageand irreversible encoding whose decoded image does not correspond with an original image in order to be accompanied by an information loss in a coding modeandgenerally a compression ratio with the higher irreversible encoding is obtained. The irreversible encoding method of an orthogonal-transformation-encoding method is typical.
[0003]Hereafterthe outline of an orthogonal-transformation-encoding method is explained.
[0004]A picture is divided into the picture element block which is a rectangular area of a pixelan orthogonal-transformation-encoding method performs orthogonal transformation for every picture element blockand it is changed into the signal of a frequency domain and it codes it. By the picture called natural picturessuch as a person and scenerysince the autocorrelation nature of a pixel value is highmost signal power after orthogonal transformation concentrates on a low-pass coefficient. Using this characterafter orthogonal transformationthe low-pass coefficient quantized accuracy highly and assigned many bitsand the coefficient of a high region is quantizing coarsely and reducing the number of bitsand has acquired the compressive effect as a whole.
[0005]An orthogonal-transformation-encoding method has a high tone reproductionand can code a photographic area with a high compression ratio. Howeversince electric power is distributed even over the coefficient of a high region when it applies to the picture which there is much edgesuch as a characterand is includedit is known that low-izing of encoding efficiency and the image quality deterioration by the omission of a high region coefficient will occur.
[0006]In the orthogonal-transformation-encoding methodsince it was called the mismatch of changing distribution of the signal power after conversion depending on the contents of the picture element blockand the code table in the case of variable length codingthe code amount for every picture element block has the always changed character.
[0007]The composition of conventional technology is explained according to the block diagram shown in drawing 5. In a figurethe block dividing part into which 100 divides the picture element block of a mxn pixel (m and n are

positive integers) out of a picture signaland 101The DCT transformation part which gives a discrete cosine transform (it is described as Discrete Cosine Transform and following DCT) to said picture element blockand outputs a conversion factorThe quantizing part which 102 quantizes said conversion factor in the predetermined quantization characteristicand outputs a quantization coefficientThe quantization table where 103 sets up the quantization characteristicthe scan conversion part which 104 scans the inside of said quantization coefficient matrix zigzagand is rearrangedand 105The buffer with which the variable length coding section which assigns a variable length code so much to the combination of the quantization coefficient which was able to be located in a line with zigzag scanning orderthe code table in which 106 registers a variable length codeand 107 accumulate said variable length code in output ordersand 108 comprise a transmission line or an accumulating part.

[0008]Hereafteroperation of a conventional example is explained based on drawing 5.

[0009]In the block dividing part 100the picture element block of a mxn pixel (m and n are positive integers) is first divided from a picture signal.
Drawing 6 (a) is a picture element block of 8x8.
This size is explained to an example below.

[0010]In the DCT transformation coding part 101the coding by the discrete cosine transform (DCT) method which is one of the conversion coding methods is performed for every divided picture element block. About the orthogonal transformation encoding by DCT. Wallace: The method indicated by "The JPEG StillPicture Compression Standard" and Communications of the ACM (April1991) is known.

[0011]Hereafteroperation of the DCT transformation coding part 101 is explained in detail.

[0012]DCT transformation is performed to the DCT transformation part 101 to the picture element block of an 8x8-pixel rectangular area inputted.
Conversion of 8th two-dimensional DCT is given by (1) formulaand inverse transformation serves as (2) types.

[0013]

[Equation 1]

It is here[Equation 2]

It comes out.

[0014]f (ij) expresses each element of a picture element blockand i and j express the position of an element. F (uv) expresses each element of a conversion factorand u and v express the position of an element. C (w) expresses C (u) or C(v).
[0015]Drawing 6 (b) is a conversion factor produced by the picture element block shown in drawing 6 (a) by performing 8th two-dimensional DCT transformation shown by (1) formula. Since the element located on the leftmost of the matrix of a conversion factor as shown in drawing 7 is equivalent to the average luminance of a picture element blockit is called a direct current coefficient. Elements other than a direct current coefficient are called an exchange coefficient.
[0016]An exchange coefficient corresponds to as horizontal a high frequency component as a right-hand side sequenceas shown in drawing 7and it corresponds to a vertical high frequency component as a lower line. Level [the element under the rightmost of a matrix] and a perpendicular direction support the highest frequency component.
[0017]It is quantized in the quantizing part 102 and the conversion factor outputted from the DCT transformation part 101 is outputted as a quantization coefficient. Quantization is processing which ** each element of a conversion factor with the element to which a quantizing matrix correspondsand asks for a quotient.
It defines as a following formula.

[0018]
$F^Q(uv) = (F(uv) + (Q\ (uv)/2))/Q\ (uv)\ (F\ (uv) >= 0)\ (F(uv) < 0)$ (4) $F^Q(uv) = (F(uv) - (Q\ (uv)/2))/Q\ (uv)$ (5) Here F (uv)Q (uv) and F^Q (uv) expresses each element of a conversion factora quantizing matrixand a quantization coefficientrespectively. u and v express the position of an element.
[0019]Drawing 6 (c) is an example of the quantizing matrix determined in consideration of the vision characteristics of each frequency component. As for the coefficient corresponding to a high frequency componentsince signal power concentrates on a low-pass coefficient in the case of natural picturesas it is shown in drawing 6 (c)a small value is set to the quantization of coefficient corresponding to a low-frequency componentaccurate quantization is performed to itand quantizing coarsely with a big value is common to it.
[0020]Drawing 6 (d) is the quantization coefficient produced by carrying out linear quantization of the conversion factor shown in drawing 6 (b) by the quantizing matrix of drawing 6 (c).
[0021]In the scan conversion part 104a quantization coefficient is zigzag scanned in order of the numbers 0-63 of the matrix shown in drawing 8and is one dimension-ized.

[0022]In the variable length coding section 105Huffman encoding of the one dimension-ized quantization coefficient is carried out. As for a dc component and an alternating current componenteach is coded individually. The Huffman coding used for coding is registered into the code table 106.
[0023]Hereaftercoding of a direct current coefficient is explained. In the case of a direct current coefficientit asks for difference with the direct current coefficient of the block before oneand it determines the group number according to drawing 9. Huffman encoding of the group number at this time is carried out. In order to show to which numerical value in a group difference correspondsthe overhead bit of the same number of bits as the group number is added.
[0024]For examplein the quantization coefficient of drawing 6 (d)supposing the dc component of the block before one is 14the difference of a dc component with a previous block will be set to 16-14=+2. As for the group number which it isdrawing 9 shows that it is 2 in this caseand binary-code'011' corresponding to the group number 2 becomes numerals from the code table of the dc component shown in drawing 10. In order to identify four values of -3-2and 2 and 3 which furthermore belong to the group number 22-bit information is added. In the case of 2'10' will be added.
[0025]Thencoding of an exchange coefficient is explained.
[0026]An exchange coefficient is coded in order of the numbers 1-63 of the matrix of drawing 8. The length (zero run) which a zero coefficient (invalid coefficient) until the coefficient (effectiveness factor) whose value is not 0 appears in this turn follows is counted. An appearance of an effectiveness factor will determine the group number according to the value of a coefficientas shown in drawing 11. The overhead bit which shows which value in a group an exchange coefficient takes is also determined.
[0027]In the code table of an exchange coefficientHuffman coding is assigned to the combination of the group number of the zero run described above and the effectiveness factor following it. Drawing 12 is a figure showing 256 kinds of combination of - (1515) by the group number of a zero run and an effectiveness factor (00). A binary code as shown in drawing 13 to each combination is given.
[0028]As mentioned abovean exchange coefficient is coded by the combination of the group number of a zero run and the effectiveness factor following itand the overhead bit which shows to which numerical value in a group an effectiveness factor corresponds further. The above operation is continued until it processes the total effectiveness factor within a block. If it turns out that all the remaining exchange coefficients within a block are zeroEOB (block termination numerals) can be coded at the timeand 1 block of processing can be completed.
[0029]Drawing 14 shows the example which coded the quantization coefficient of

drawing 6 (d) according to the above procedure. Drawing 15 shows the bit string outputted as numerals. Information (8 bits per pixel and 8x8 pixels per block all the 512 bits) is compressed into 63 bits.
[0030]In the case of decodingHuffman decoding is performed in a procedure contrary to having mentioned aboveand the quantization coefficient of drawing 6 (d) is reproduced. Thenthe inverse quantization factor of drawing 6 (e) is obtained by multiplying by the element corresponding to each quantization coefficient in the quantizing matrix of drawing 6 (c). The decoding picture element block of drawing 6 (f) can be obtained by performing reverse DCT transformation of (2) types to an inverse quantization factor.
[0031]By the above processingit can code with a conversion coding method and picture information can be decoded. The size of the code data based on a conversion coding method is changed depending on the contents of the picture element block.
[0032]The code data outputted from the variable length coding section 105 is accumulated in the variable length code buffer 107.
[0033]It is based on the above composition and operationand a picture signal is coded and decoded by a conversion coding method.
[0034]
[Problem(s) to be Solved by the Invention]Howeverwhen a code amount was changed according to the contents for every picture element block when a picture signal is coded with a conversion coding methodand a picture element block contained edgesuch as a characterand a high frequency component like the halftone dot of a printing manuscriptit had the character in which encoding efficiency fell. For this reasonwhen applying a conversion coding method to a actual image processing devicethere were the following problems.
[0035]Usuallythe speed by which code data is outputted and inputted is restricted by the upper limit corresponding to the speed of a transmission lineand the input-and-output speed of an accumulation device.
[0036]For this reasonin the case of codingwhen encoding efficiency fallsthe output of the code data to the picture element block inputted with constant speed will increaseWhen the yield of code data exceeded said upper limitthe input stoppage of a picture element block or the input speed of the picture element block needed to be reduced.
[0037]In the case of decodingsince a code data amount required to generate a fixed decoding picture element block will increase if a compression ratio fallsit is necessary to supply many code data with a decoder. When the code data amount to transmit exceeds the above-mentioned upper limitit stops being enough for decoding with the constant speed of a picture element blockand the output halt of a decoding picture element block or the output delay of a decoding picture element block will occur.

[0038]Specifically generating these problems in the following situations is known.
[0039]1-1. Carry out the scanner input of the manuscript including a character area or a dot areaand when carrying out sequential encoding of this and accumulating in a storage devicesince a generated code amount increases by existence of edgethe input speed of a storage device poses a problem in a character area.
[0040]1-2. The code data accumulated in the storage device is decodedand when printing a decoded image with a serial printerfixed decoding speed is called for. For examplein order to form an electrostatic latent image in the printer of a xerography method on the sensitized material which rotates with constant speed by the laser beam which modulated the picture signalA picture signal always needs to be inputted synchronizing with a fixed clockand an image clock cannot be changed to compensate for change of the decoding speed of a pictureor it cannot stop.
[0041]2-1. In carrying out sequential encoding of the frame signal of the digital dynamic image inputted with the camera etc.or the differential signal of a frame signal and accumulating in a storage devicesince a code amount will increase if a motion of a photographic subject is large or a scene change occursthe input speed of a storage device poses a problem.
[0042]2-2. When reading the code data of the digital dynamic image beforehand accumulated in the storage devicedecoding a picture signal and a fixed decoding pixel rate cannot be filledtop dropping will occur and deterioration of quality will be caused.
[0043]It aims at acquiring the data compression effect that it is high even when distribution of an input data value becomes large and it becomes on the other handIt faces coding video information data by a discrete cosine transform etc.and the video information compression encoding apparatus which codes the data after conversion with an encoder for exclusive use by dividing into twoa ″direct-current + exchange low-pass″ ingredient and an ″exchange quantity region″ ingredientrespectively is indicated to JP5-236450A.
[0044]Howeverin order to aim at improvement in encoding efficiency in the gazette in the coding equipment of a statementthere was a problem that the memory for preparing the optimal code table for every divided zoneand memorizing each code table increased. After coding the same zone with several different coding equipmentit determined whether to choose which output codes according to a code amountand since identification information was added and outputtedexcessive processing had occurred from a viewpoint of improvement in the speed.
[0045]Thereforewithout increasing the memory for numerals in view of the problem mentioned above in this inventionIt aims at not being based on the

maximum of the transmission line which is an input and output point of code dataand the input-and-output speed of an accumulation devicebut providing coding of the image in a stable speedand the coding decoding device of the picture signal which decoding can realize.
[0046]
[Means for Solving the Problem]In the invention of this invention according to claim 1 this inventionA block division means which divides a picture signal into a picture element block which is a rectangular area of a MxN pixel (M and N are positive integers)An orthogonal transformation means which performs orthogonal transformation to said picture element blockand calculates a conversion factorCoding equipment of a picture signal provided with a quantization means which quantizes said conversion factor in the predetermined quantization characteristicand obtains a quantization coefficientand a variable-length-coding means to carry out variable length coding of said quantization coefficientand to obtain code data is characterized by comprising:
A zone division means to divide said quantization coefficient into two or more relatively prime subsets.
Two or more variable-length-coding means to carry out variable length coding for every subset of said quantization coefficientand to obtain code data for every subset.
Two or more memory or transmission means which memorize or transmit code data for said every subset individually.

[0047]In [again] the invention of this invention according to claim 2 this inventionA block division means which divides a picture signal into a picture element block which is a rectangular area of a MxN pixel (M and N are positive integers)An orthogonal transformation means which performs orthogonal transformation to said picture element blockand calculates a conversion factorCoding equipment of a picture signal provided with a quantization means which quantizes said conversion factor in the predetermined quantization characteristicand obtains a quantization coefficientand a variable-length-coding means to carry out variable length coding of said quantization coefficientand to obtain code data is characterized by comprising:
A zone division means to divide said conversion factor into two or more relatively prime subsets.
Two or more quantization means which quantize for every subset of said conversion factorand obtain a quantization coefficient for every subset.
Two or more variable-length-coding means to carry out variable length coding of the quantization coefficient for said every subsetand to obtain code data for every subset.

Two or more memory or transmission means which memorize or transmit code data for said every subset individually.

[0048]In the invention of this invention according to claim 3in any 1 paragraph of claim 1 or claim 2in coding equipment of a picture signal of a statement Said conversion factorOr when dividing said quantization coefficient into two or more relatively prime subsetsa boundary of division is set up by the position of a one-dimensional series acquired by scanning zigzag from low-passapplying inside of a matrix of said conversion factor or said quantization coefficient to a high region.

[0049]In [again] the invention of this invention according to claim 4 this inventionMemory or a transmission means which memorizes or transmits code dataand a variable-length decoding means which carries out variable-length decoding of said code dataand obtains a quantization coefficientAn inverse quantization means to carry out inverse quantization of said quantization coefficientand to obtain a conversion factorand an inverse-orthogonal-transformation means to carry out inverse orthogonal transformation of said conversion factorand to obtain a decoding picture element blockA decoding device of a picture signal provided with a block synthesizing means which compounds said decoding picture element block and generates a decoded image signal is characterized by comprising:

Memory which memorizes or transmits code data for said every subset individuallyor a transmission means.

Two or more variable-length decoding means which carry out variable-length decoding of the code data for said every subset individuallyand obtain a quantization coefficient for every subset.

A band composition means to compound a quantization coefficient for said every subsetand to obtain a quantization coefficient for 1 block.

[0050]Further in the invention of this invention according to claim 5 this inventionMemory or a transmission means which memorizes or transmits code dataand a variable-length decoding means which carries out variable-length decoding of said code dataand obtains a quantization coefficientAn inverse quantization means to carry out inverse quantization of said quantization coefficientand to obtain a conversion factorand an inverse-orthogonal-transformation means to carry out inverse orthogonal transformation of said conversion factorand to obtain a decoding picture element blockA decoding device of a picture signal provided with a block synthesizing means which compounds said decoding picture element block and generates a decoded image signal is characterized by comprising:

Memory which memorizes or transmits code data for said every subset

individuallyor a transmission means.
Two or more variable-length decoding means which carry out variable-length decoding of the code data for said every subset individuallyand obtain a quantization coefficient for every subset.
Two or more inverse quantization means to carry out inverse quantization of the quantization coefficient for said every subset individuallyand to obtain a conversion factor for every subset.
A band composition means to compound a conversion factor for said every subsetand to obtain a conversion factor for 1 block.

[0051]
[Function]A block division means divides the picture element block of a MxN pixel (M and N are positive integers) from a picture signalorthogonal transformation is performedand a conversion factor is obtained. Information is reduced by quantizing this conversion factor by a quantization meansand a quantization coefficient is obtained. Since it is divided into two or more subsets and is individually coded by two or more variable-length-coding means by the code data for every subsetthe quantization coefficient can accelerate processing. Since it is small compared with the code data which carried out variable length coding of the whole-quantity child-ized coefficientthe code data for every subset can reduce the time which individual memorythe memory by a transmission meansor transmission takes.
[0052]From the memory or the transmission means which accumulated or transmits code datathe code data of ** is obtained the whole subset and the quantization coefficient for every subset is decoded by two or more variable-length decoding means. Since it will be carried out by the read operation of code data or transmission operationand variable-length decoding operation standing in a rowprocessing becomes high-speed. After carrying out inverse quantization of the quantization coefficient obtained in the above-mentioned procedure and obtaining a conversion factorinverse orthogonal transformation can be performed and a decoding picture element block can be obtained. A decoded image signal is reproduced by compounding a decoding picture element block. Since the processing speed after variable-length decoding processing is not changedthe stable decoding speed is obtained by the above-mentioned parallel operation.
[0053]
[Example]Drawing 1 (a) is a figure explaining the principle of the coding mode of this invention. Composition is explained according to figures.
[0054]The block division means into which 1 divides the picture element block which comprises the rectangular area of a MxN pixel (M and N are positive integers) from a picture signal in a figureand 2The orthogonal transformation

means which performs orthogonal transformation to said picture element blockand obtains a conversion factorand 3The quantization means which quantizes said conversion factor and outputs a quantization coefficientand 4A variable-length-coding means for a zone division means to divide said conversion factor into two or more zonesand 5a5b and 5c to carry out variable length coding of each quantization coefficient divided for every zoneand to output code dataand 6a6b and 6c are accumulationor the memory/transmission means to transmit about said code data.

[0055]Hereafterencoding operation is explained based on drawing 1 (a).

[0056]A picture signal is divided into the picture element block of a MxN pixel by the block division means 1 like the conventional conversion coding method. Orthogonal transformation is performed by the orthogonal transformation means 2and a picture element block is changed into the conversion factor which is the information on frequency space.

[0057]It is quantized by the quantization means 3 in the predetermined quantization characteristicand a conversion factor is outputted as a quantization coefficient.

[0058]A quantization coefficient is rearranged into a one-dimensional series by the given order in the zone division means 4. A quantization coefficient is divided into two or more subsets (zone) by the position beforehand set up into the one-dimensional series. Zones do not have overlap mutuallyi.e.division into these zones is performed so that there may be no quantization coefficient belonging to two or more zonesand it may become relatively prime.

[0059]Drawing 2 is a quantization coefficient of 8x8 produced by performing orthogonal transformation and quantization to 8x8 picture element blockthe turn which carries out the one-dimensional systematization of thisand a figure explaining the division into a relatively prime zone. The number of 0 to 63 in a figure shows scanning order when one dimension-izing this quantization coefficient. The thick line in a figure shows the boundary where a quantization coefficient is dividedwhen "20" and "48" are given as a dividing position of a zone. The boundary line in a figure can divide into the quantization coefficient (zone 1) to 0-20the quantization coefficient (zone 2) of 21-48and the quantization coefficient (zone 3) of 49-63 in order of a scanning.

[0060]In the variable-length-coding means 5a and 5bvariable length coding of the quantization coefficient divided by the zone division means 4 is carried out individually. When carrying out variable length coding of the quantization coefficient belonging to the zone 1 of drawing 2coding of a dc component is applied to the quantization coefficient of the position of "0" like a conventional systemand coding of an alternating current component is applied to the quantization coefficient of "1-20." In the case of the zone 2 and the

zone 3coding of an alternating current component is applied to the quantization coefficient of "21-48" and "49-63"respectively. Also in which zonewhen all the coefficient values to the last coefficient position are zeroEOB (block termination numerals) shall be coded and the encoding operation of the zone concerned shall be completed.
[0061]the code data coded for every zone by the above procedure -- individual -- memory / transmission means 6a6band 6c -- accumulation -- or it is transmitted.
[0062]Drawing 1 (b) is a figure explaining the principle of the decode system of this invention. Hereaftercomposition is explained according to figures.
[0063]In a figure11a11band 11c are accumulated in memory / transmission means 6a6band 6c. The variable-length decoding means which decodes the code data for every transmitted zoneand reconstructs the quantization coefficient in the case of coding for every zone and 10[or] A band composition means to compound the quantization coefficient for said every zoneand to output the quantization coefficient corresponding to a picture element blockand 9An inverse quantization means to carry out inverse quantization of said quantization coefficientand to obtain the conversion factor for every zonean inverse-orthogonal-transformation means for 8 to perform inverse orthogonal transformation to said conversion factorand to generate a decoding picture element blockand 7 are block synthesizing means which compound a decoding picture element block and reconstruct a decoded image.
[0064]Decoding operation is explained based on drawing 1 (b).
[0065]the code data for every [according / on drawing 1 (b) and / to the coding mode of this invention in memory / transmission means 6a6b and 6c] zone -- individual -- accumulation -- or it is transmittedand is decoded by the variable-length decoding means 11a11band 11cand the quantization coefficient for every zone is reconstructed. In the band composition means 10the quantization coefficient for 1 block is compounded by a procedure contrary to the zone division in the case of coding. Inverse quantization of the quantization coefficient is carried out by the inverse quantization means 9and a conversion factor is reproduced. The picture element block which inverse orthogonal transformation was performed to the conversion factor in the inverse-orthogonal-transformation means 8and was decoded is compounded in the block synthesizing means 7and a decoded image is reproduced.
[0066]Coding decoding of the picture signal can be carried out by the above composition and operation.
[0067]Although the number of zones to divide was explained as 3 abovein this inventionit does not limit to thisand the number of partitions more than two division or trichotomy is also possible.
[0068]Although the zone division means 4 is performing zone division to the

quantization coefficient in drawing 1 (a) quantized by the quantization means 3it is also possible to replace the quantization means 3 and the zone division means 4. That isafter performing zone division to the conversion factor which the orthogonal transformation means 2 outputsthe effect by this invention is acquired also by having two or more quantization means 3 which quantize the conversion factor for every zone individually.
[0069]In the decode system of drawing 1 (b)the connecting relation of the inverse quantization means 9 and the band composition means 10 can be replaced similarly. In that caseit has two or more inverse quantization means 9 to correspond to the quantization coefficient for every zone in which variable-length decoding was carried out by the variable-length decoding means 11a11band 11cthe conversion factor for every zone produced by performing inverse quantization for every zone is compounded by the band composition means 10and a conversion factor is obtained.
[0070]The composition of the example of this invention is explained based on example 1 drawing 3. Although explained as a unit of processing of an 8x8-pixel picture element block belowthis invention is not limited to this.
[0071]Drawing 3 (a) is a lineblock diagram of the example of the coding mode of this invention. The block dividing part into which 100 divides an 8x8-pixel rectangular area as a picture element block from a picture signal in a figureThe DCT transformation part which 101 performs two-dimensional DCT transformation to said picture element blockand obtains a conversion factorand 102The quantizing part which quantizes said conversion factor and outputs the quantization coefficient for every zoneWhile the quantization table which set up the quantization characteristic for 103 to carry out linear quantization of said conversion factor as a quantizing matrixand 109 rearrange said quantization coefficient into a one-dimensional series againThe scanning dividing part which divides a conversion factor into two zones bordering on a predetermined coefficient positionThe variable length coding section which 105a and 105b carry out variable length coding of the quantization coefficient for said every zone individually according to a predetermined procedureand is outputted as code data for every zoneThe code table in which 106 registered the variable length code which the variable length coding sections 105a and 105b useThe code buffer in which 107a and 107b accumulate the code data for said every zoneand 108a and 108b are the accumulating parts for accumulating the transmission line for transmitting the code data in said code bufferor the code data in said code buffer.
[0072]The same number is given to the composition of drawing 5and a corresponding part among the figure.
[0073]Drawing 4 is a figure showing the composition of the scanning dividing part 109 in drawing 3 (a). Hereaftercomposition is explained based on figures.

[0074]The coefficient buffer which accumulates the quantization coefficient as which 70 is inputted in a figureThe address generation part which generates the address of a quantization coefficient with which 71 is read from the coefficient buffer 70The selector which changes the output destination change of a quantization coefficient where 72 was read from the coefficient buffer 70the change judgment part which outputs the change directions to the selector 72 based on the address information to which the address generation part 71 outputs 73and the one-dimensional coefficient buffer which accumulates the quantization coefficient with which 74a and 74b were scanned by the one-dimensional series -- it comes out.
[0075]Hereafterencoding operation is explained based on drawing 3 (a).
[0076]About operation of the block dividing part 100the DCT transformation part 101and the quantizing part 102since the paragraph of conventional technology explainedit omits.
[0077]Operation of the scanning dividing part 109 is explained based on drawing 4.
[0078]The quantization coefficient outputted from the quantizing part 102 is first accumulated in the coefficient buffer 70and the quantization coefficient corresponding to the coefficient reading address outputted from the address generation part 71 is outputted to the selector 72. The coefficient reading address outputted from the address generation part 71 corresponds to an order which scans the inside of a conversion factor matrix zigzagfor exampleas shown in drawing 2. This coefficient reading address is inputted also into the change judgment part 73. In the change judgment part 73the coefficient reading address inputted judges whether it is a front [boundary position / which was set as zigzag scanning order by matching]or it is the backand outputs the change directions to the selector 72. For examplewhen the 35th of zigzag scanning order is a boundary positionin the quantization coefficient matrix of drawing 2 in the change judgment part 73. The quantization coefficient read from the coefficient buffer 70 judges and changes the case of 0-35and the case of 36-63 in order of a zigzag scanand outputs directions.
[0079]In the selector 72based on change directions of the change judgment part 73the quantization coefficient of the zigzag scanning order 0-35 read from the coefficient buffer 70 is changed to the one-dimensional coefficient buffer 74athe quantization coefficient of the zigzag scanning order 36-63 is changed to the one-dimensional coefficient buffer 74band it outputs.
[0080]Variable length coding of the quantization coefficient accumulated in the one-dimensional coefficient buffers 74a and 74b is individually carried out by the variable length coding sections 105a and 105b. Howeverin the variable length coding section 105acoding of a direct current shall be applied to the quantization coefficient of the zigzag scanning order 0. About

variable-length-coding operationsince the portions of the paragraph of conventional technology and the principle of this invention already explainedit omits.
[0081]Explanation is omitted for the same reason also about the code buffers 107a and 107ba transmission lineor the accumulating parts 108a and 108b.
[0082]A picture signal can be coded by the above composition and operation.
[0083]Drawing 3 (b) is a lineblock diagram of the example of the decode system of ********. The code buffer in which 208a and 208b accumulate 207aand a transmission line or an accumulating partand 207b accumulate the code data for every zone in a figureThe variable length decoding part in which 105a and 105b decode the code data for every zoneThe scanning synchronizer which compounds the code table in which 106 sets up the code table for variable-length decodingand 209 while they carry out scanning conversion of the one-dimensional quantization coefficient decoded for every zoneand generates the quantization coefficient for 1 blockThe inverse quantization part which 202 performs inverse quantization to said quantization coefficientand reproduces a conversion factorthe inverse quantization table where 103 set up the inverse quantization characteristicthe IDCT conversion part which 201 carries out IDCT (Inverse DCT) conversion of said conversion factorand outputs a decoding picture element blockand the block synchronizer which 200 compounds a decoding picture element block and constitutes a decoded image signal -- it comes out.
[0084]Hereafteroperation is explained based on drawing 3 (b).
[0085]The code data for every zone generated by the example of the coding mode of this invention is read from a transmission line or the accumulating parts 108a and 108band is accumulated in the code buffers 107a and 107b. It is decoded by the variable-length decoding means 105a and 105band the quantization coefficient for every zone is restored. The code table corresponding to the numerals set as the code table 106 on the occasion of coding is set to the decoding table 206.
[0086]The quantization coefficient for every zone is re-compounded by the scanning synchronizer 209and scanning conversion is carried out to the quantization coefficient matrix for 1 block from a further one-dimensional data series.
[0087]Inverse quantization is performed in the quantization characteristic corresponding to the quantization characteristic that the quantization coefficient was set [in / after that / the inverse quantization part 202] as the quantization table 103 on the occasion of codingand a conversion factor is generated.
[0088]As for a conversion factorinverse transformation processing of DCT is performed in the IDCT conversion part 201and a decoding picture element block is reproduced. A decoding picture element block is compounded in the block

synchronizer 200and a decoded image signal is reproduced.
[0089]By the above composition and operationthe code data generated by the coding mode of this invention can be decodedand a picture signal can be reproduced.
[0090]In this examplealthough explained taking the case of DCT transformation as orthogonal transformationit is also possible not to limit this invention to this and to use other orthogonal transformation methodssuch as a Hadamard transform and slant conversion.
[0091]In the scanning dividing part 109although the order of the zigzag scan is used for one dimension-izing a conversion factoryou may be other scanning order. The classification of a coefficient is not limited to 2 setseither.
[0092]In the example of the coding mode of this invention shown in drawing 3 (a)although zone division is performed by the scanning dividing part 109 to the quantization coefficient quantized by the quantizing part 102it is also possible to replace the quantizing part 102 and the scanning dividing part 109. That isafter performing zone division to the conversion factor which the DCT transformation part 101 outputseven if it quantizes the conversion factor for every zone individuallythe effect by this invention is acquired.
[0093]
[Effect of the Invention]As explained abovesince the variable length coding section and variable length decoding part which are a factor of the velocity turbulence in an orthogonal-transformation-encoding method were parallelized and input and output of the code data were distributedby this inventionthe input-and-output speed of code data can be reduced.
[0094]It is stabilized by this also with the transmission line where access speed is slowand a storage device with a slow input-and-output speedand input and output of code data are attainedCoding and decoding operation become possiblewithout stopping input and output of a picture signaland reducing input-and-output speedeven if the picture element block which there are many high region coefficients and is generated continues.
[0095]Since it can respond by fluctuating the number of parallelization in the case of various transmission lines and a storage devicethe pliability of a system configuration can be improved.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a principle explanatory view of this invention.
[Drawing 2]It is a figure explaining zone division.
[Drawing 3]It is a lineblock diagram of the example of this invention.

[Drawing 4]It is a figure showing the lineblock diagram of a scanning dividing part.
[Drawing 5]It is a lineblock diagram of conventional technology.
[Drawing 6]It is a figure showing the example of DCT transformation and quantization.
[Drawing 7]It is a figure showing a conversion factor.
[Drawing 8]It is an explanatory view of one dimension-izing by a zigzag scan.
[Drawing 9]It is a figure showing the grouping of a direct current coefficient.
[Drawing 10]It is a figure showing the Huffman code table of a direct current coefficient.
[Drawing 11]It is a figure showing the grouping of an exchange coefficient.
[Drawing 12]It is a figure showing the two-dimensional Huffman encoding of an exchange coefficient.
[Drawing 13]It is a figure showing the Huffman code table (part extract) of an exchange coefficient.
[Drawing 14]It is a figure showing the example of coding of the quantization coefficient of drawing 6 (c).
[Drawing 15]It is a figure showing the bit string outputted.
[Description of Notations]
1 [-- Zone division means] -- A block division means2 -- An orthogonal transformation means3 -- A quantization means4 5a5b5c -- A variable-length-coding means6a6b6c -- Memory/transmission means7 [-- Band composition means] -- A block synthesizing means8 -- An inverse-orthogonal-transformation means9 -- An inverse quantization means10 11a11b11c -- A variable-length decoding means70 -- A coefficient buffer71 -- Address generation part72 -- A selector73 -- A change judgment part74a74b -- One-dimensional coefficient buffer100 -- A block dividing part101 -- A DCT transformation part102 -- Quantizing part103 -- A quantization table104 -- A zigzag scan converter105105a105b -- Variable length coding section106 -- A code table107107a107b -- Code buffer108108a108b -- A transmission line or an accumulating part109 -- A scanning dividing part200 [-- An inverse quantization table204 / -- A reverse zigzag converter205a205b / -- A variable length decoding part206 / -- A decoding table207a 207b / -- A code buffer209 / -- Scanning synchronizer] -- A block synchronizer201 -- An IDCT conversion part202 -- An inverse quantization part203